

**Response to Agency Comments on the Draft Baseline Human Health Risk Assessment Work Plan for the Patrick Bayou Superfund Site**

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1	Figure 3-1 Conceptual Site Model and Sections 3.1	<p><b>TCEQ/ Receptors and Pathways to be Evaluated in the BHHRA</b></p> <p>Figure 3-1 indicates that the only pathways to be evaluated in the BHHRA are: (1) incidental ingestion and dermal contact with sediment by a future construction worker; and (2) the ingestion of biota by an off-site recreational receptor. Although there is discussion about the likelihood of exposures in Section 3.1, fencing of land and security zones on the Houston Ship Channel which discourage access to the site by land/water may not prevent recreational receptor/trespasser exposure. Additionally, although Section 3.1 indicates no known current exposures for on-site workers, it lists routine activities which may result in exposure (e.g., mowing and vegetative maintenance along the bayou, fence maintenance). <i>In the face of uncertainty and the absence of more significantly impacted receptor types (e.g., the standard commercial/industrial worker), the BHHRA should err on the side of conservative exposure assumptions for construction workers (see comments below on Sections 5.1.1 and 6.1.2.1.1), on-site workers (for routine activities), and potential recreational receptors (on-site sediment) and trespassers (on-site sediment).</i> Alternatively, more robust justifications should be provided for not evaluating (i.e., including risk/hazard calculations for) surface water exposure to a future construction worker and not evaluating current and/or future sediment and surface water exposure by contact recreational receptors, trespassers, and on-site workers in the BHHRA.</p>	<ol style="list-style-type: none"> <li>Reasonable and complete information has been used to identify recreational and trespasser scenarios as incomplete for this site (see Section 2 and 3 of the BHHRA WP and the Preliminary site characterization report [2006]).</li> <li>Potential maintenance activities may occur along the boundary of the site (i.e., shoreline); however, given the nature of activities and the low frequency of occurrence for such activities, any exposure to site media is not considered significant. Therefore, the maintenance worker scenario will be identified as complete but insignificant and will be assessed qualitatively in the uncertainty assessment of the BHHRA.</li> <li>For the construction worker scenario, the exposure frequency will be increased from 20 days/year to 60 days/year in the screening level calculation scenarios. A revised screening of chemicals will be performed based on the adjustments to the screening levels (SL).</li> <li>The JDG maintains that surface water exposure for a construction worker would be minimal and would not contribute significantly to the overall risk for this receptor; therefore the pathway is complete but not significant and will be addressed qualitatively in the uncertainty assessment for the BHHRA.</li> </ol>	
2	Section 3.2.1	<p><b>TCEQ/</b> Section 3.2.1 indicates that since there is no potable groundwater use at the site, exposure to groundwater is not considered a complete pathway. However, potential future use is apparently not considered. <i>If groundwater has been impacted, this media should be evaluated based on its classification (class I, II, or III) under §350.52 of TRRP.</i> The ingestion of class I and II groundwater is considered to be a complete or reasonably anticipated to be complete exposure pathway under TRRP (§350.71(c)). Additionally, for any volatile COPCs, TRRP has groundwater protective concentration levels (PCLs) which only consider the volatilization of COPCs to ambient air (i.e., residential <sup>Air</sup>GW<sub>Inh-V</sub> PCLs).</p>	<p>The three industrial facilities that border Patrick Bayou are actively engaged with TCEQ in addressing potential groundwater issues under TRRP or the Voluntary Cleanup Program for their on-site programs. The comprehensive groundwater characterization programs that have been performed by OxyVinyls, Shell, and Lubrizol all show that shallow and deep groundwater underlying the facilities flows towards Patrick Bayou. The Patrick Bayou Superfund Site Boundary is coincident with the shoreline and does not encroach on the upland where potential groundwater wells would be completed. Because groundwater flows towards Patrick Bayou, porewater within the sediments of the bayou would not be able to flow upgradient and contaminant areas where potential groundwater wells could be completed. The current physical Conceptual Site Model indicates that Patrick Bayou is not a source to groundwater, and groundwater ingestion from wells within the Site boundary is not considered a complete pathway in the context of a human health risk assessment for the Site. A groundwater report that focuses on identifying if groundwater from upgradient areas outside of the Site boundary could be significant sources of potential contaminant loading to the Site is in preparation. Results of this report will be evaluated to support or modify the current Conceptual Site Model and incorporated in the BHHRA as appropriate.</p>	
3	Sections 3.1.1, 5.4, and 8.1.1.4	<p><b>TCEQ/ Recreational Fisher Evaluation</b></p> <p>Section 3.1.1 indicates that the necessity to include recreational fish consumption in the BHHRA will be determined based on estimating the contribution of Patrick's Bayou chemicals of potential concern (COPCs) to recreational-sized fish (e.g., catfish, speckled seatrout, croaker) and blue crab caught at San Jacinto Monument Park (the purported nearest downstream off-site recreational fishing location). TD is concerned with the uncertainty associated with this evaluation based on review of Sections 5.4 and 8.1.1.4. Although site COPCs may be affecting tissue concentrations for fish/shellfish exposed there, TD believes demonstrating that through the finding of a spatial trend based on Texas Department of State Health Services and TCEQ Total Maximum Daily Load (TMDL)</p>	Noted.	

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		tissue data to be unlikely given: (1) the mobility of fish, (2) the distance from the site to the San Jacinto Monument Park being used as the point-of-exposure (POE) and reference for identifying trends (1.4-2.4 miles from the site), and (3) the confounding influence of fish tissue results from fish which were never exposed to COPCs at the site but may have been exposed to the same COPC due to other sources along the highly industrialized Houston Ship Channel (i.e., obviously, a relatively small pristine environment where Patrick's Bayou is the only source of cope contamination is not being assessed here where any tissue impacts and trends due to exposure at the site could be readily identified). If site COPCs are appreciably contributing to fish/shellfish tissue levels for those exposed to site contamination, the particularly uncertain assumption for the spatial evaluation appears to be that fish in a highly industrialized waterbody at the POE 1.4-2.4 miles away from the actual site will have sufficiently elevated COPC levels due to site contamination such that tissue concentration trends with distance from the POE will be apparent. <i>The TCEQ project manager may decide to have TCEQ staff with more expertise in this area review the rationale behind the expectation of fish/shellfish tissue spatial trends in COPCs (if site contamination was making contributions) made in the draft BHHRA work plan for screening COPCs and identifying the contribution of site contaminants to fish/shellfish tissue levels in the Houston Ship Channel (e.g., Sections 5.4 and 8.1.1.4, Figures 4-2 to 4-3 and 5-2a to 5-4c, Attachment 1).</i>		
4	Sections 5.4 and 4.3.2	<b>TCEQ/</b> Given the apparent high inherent uncertainty of this trend evaluation, TD does not believe this screening to be reliable. As such, it has significant potential for excluding COPCs from the recreational fisher pathway evaluation in the BHHRA. The only COPCs retained in Section 5.4 are polychlorinated biphenyls (PCBs) and dioxins/furans (metals and pesticides were screened out). As fish in the Houston Ship Channel already have significant levels of these COPCs, TD believes the evaluation of contribution from the site is less likely to result in a decision to address them. By the same type of evaluation and reasoning, many sources on the Houston Ship Channel would likely go unaddressed, and fish tissue levels would never be reduced such that the fishing advisory could be removed because individually, each source could not be demonstrated to have contributed enough to fish tissue levels to warrant remediation action. The collection of tissue data from fish and shellfish caught at the site itself is planned as stated in Section 4.3.2. TD strongly advocates the collection of these data to help inform site contributions to COPC tissue levels and the evaluation of the recreational fisherman receptor in the BHHRA. <i>Use of these site tissue data, which are more likely to reflect contamination by site COPCs than samples taken 1.4-2.4 miles away, to calculate risk/hazard would prevent the potential dilution of results (both tissue levels and risk/hazard estimates) which may result from using fish/shellfish caught at/near the San Jacinto Monument Park.</i> In addition, an informative evaluation would be to assess the acceptability of site impacts on edible tissue by comparison of media sample results to sediment and surface water concentrations which are calculated to be protective of fish/shellfish tissue and subsequent human ingestion.	<ol style="list-style-type: none"><li>1. For organochlorine pesticides, two Texas Department of State Health Services (TDSHS) health consultation reports reach similar conclusions as our trend analysis (TDSHS 2001, 2005). The reports state that organochlorine pesticides in fish tissue are highest upstream of Patrick Bayou (i.e., near the Turning Basin); indicating a source upstream of Patrick Bayou. Arsenic and mercury were also removed as COPCs after the trend analysis evaluation; 1) there was no clear pattern indicating Patrick Bayou as a source and there are no advisories for these metals, as they do not pose risk to humans in the HSC (TDSHS 2001, 2005).</li><li>2. Due to the security, lack of access and other controls in place, there is no reasonable expectation that fish or shellfish will be caught and consumed from Patrick Bayou now or in the future; supporting the designation of the HSC (i.e., San Jacinto Monument) as an appropriate point of exposure. Assuming Patrick Bayou as the point of exposure would result in an inappropriate exposure assessment.</li><li>3. Use of sediment data and generic BSAFs or similar (as suggested by the reviewer) to estimate fish tissue residues in the BHHRA should not be performed given the great degree of uncertainty in the generic BSAF approach. Furthermore, it is not appropriate to use such an approach for organisms that have large home ranges (i.e., recreationally caught and consumed fish and shellfish).</li></ol> <p>TDSHS (Texas Department of State Health Services), 2001. <i>Health Consultation - Houston Ship Channel and Tabbs Bay</i>. Prepared for Toxic Substances and Disease Registry. Report HSCHC3d 08-01-01. Revised 11-20-01.</p>	

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			TDSHS, 2005. Characterization of Potential Health Risks Associated with Consumption of Fish or Blue Crabs from the Houston Ship Channel, the San Jacinto River (Tidal Portions), Tabbs Bay, and Upper Galveston Bay. Prepared by Department of State Health Services Seafood and Aquatic Life Group. January 2005.	
5	Sections 5.1.2 and 6.1.2.2.1	<b>TCEQ/</b> Section 5.1.2 refers to the calculation of fish/shellfish tissue screening values, and Section 6.1.2.2.1 indicates that the exposure duration for reasonable maximum exposure (RME) is 30 years. Please note that TRRP-24 ( <a href="http://www.tceq.texas.gov/publications/rg/rg-366_trrp_24.html/at_download/file">http://www.tceq.texas.gov/publications/rg/rg-366_trrp_24.html/at_download/file</a> ) does not use an exposure duration, which makes the TRRP evaluation more conservative (i.e., carcinogenic risk higher). However, this is off-set somewhat by the higher fish ingestion rate (25 g/day) to be used for RME in the BHHRA. <i>TD believes the RME fisher scenario should be used to make decisions regarding the need for remediation action as the overall risk/hazard results are expected to be similar to an evaluation under TRRP-24 (unlike the central tendency exposure (CTE) scenario with an intake rate of 17.5 g/day and an exposure duration of only 9 years as discussed in Section 6.1.2.2.2).</i>	The RME scenario will be used to identify contaminants of concern (COC) in the BHHRA.	
6	Section 5.2.2 and Table 5-5	<b>TCEQ/</b> Section 5.2.2 and Table 5-5 indicate that fish/shellfish tissue COPCs with maximum detections less than their screening levels were eliminated from the BHHRA. Most of the eliminated COPCs have a screening levels based on noncarcinogenic effects (e.g. a hazard quotient (HQ) of 1). This screening provides an example of how eliminated COPCs could have potentially significantly contributed to the hazard index (HI). Based on maximum detections for eliminated COPCs, the total HI eliminated with these COPCs was about 0.82, which would account for 82% of the acceptable USEPA HI of 1. The HI eliminated based on 95% upper confidence limit (UCL) exposure point concentrations (EPCs) could be fairly similar or at least significant, although it is unknown absent 95% UCL calculations. <i>This example illustrates how this screening procedure could significantly underestimate fish/shellfish tissue risk in the BHHRA.</i>	For fish and shellfish tissue exposures, the hazard index (HI) for all non-carcinogenic chemicals (absent mercury) is 0.82. This is not a level of concern under USEPA guidance (USEPA 1989). However, when mercury is included in the calculation of the HI, the HI becomes 7.1 (mercury HQ is 6.3). The incremental contribution of the other chemicals to the HI is small relative to mercury. Therefore, the incremental contribution of the chemicals with HQs < 1.0 are considered below a threshold warranting their inclusion as COPCs. Finally, under TCEQ guidance, when a HI is > 10 there should be a concern for the COPCs that contribute to the HI (TCEQ 2008). Specifically, for non-carcinogenic COCs, “The hazard index for multiple non-carcinogenic COCs shall not exceed 10.”  USEPA (U.S. Environmental Protection Agency), 1989. Risk Assessment Guidance for Superfund (RAGS), Volume I – Human Health Evaluation Manual (Part A), Interim Final (USEPA-540-1-89-002), OSWER Directive 9285.7-01A. December 1, 1989.  TCEQ, 2008. Risk Levels, Hazard Indices, and Cumulative Adjustment, TCEQ Regulatory Guidance, Remediation Division. RG-366/TRRP-18 Revised October 2008).	
7	Sections 4.1.1	<b>TCEQ/Sediment Evaluation</b> Section 4.1.1 indicates that sediment samples from 0-11 cm will be considered surface sediment and > 11 cm will be considered subsurface sediment. <i>Please be aware that sediment from 0-12 inches (0-30.5 cm) is considered relevant for human exposure under TRRP-24 (available at <a href="http://www.tceq.texas.gov/publications/rg/rg-366_trrp_24.html/at_download/file">http://www.tceq.texas.gov/publications/rg/rg-366_trrp_24.html/at_download/file</a>).</i>	Noted.	

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8	Sections 5.1.1 and 6.1.2.1.1	<b>TCEQ/</b> Sections 5.1.1 and 6.1.2.1.1 indicate that professional judgment was used for the assumed RME construction worker exposure frequency of 20 days per year (10 days for central CTE), and the incidental ingestion rate was assumed to be 100 mg/day. Additionally, the exposure duration is assumed to be 12.5 years (9 years for central tendency exposure) based on professional judgment. For a construction worker, please note that TCEQ has historically used an exposure frequency of 60 days per year (5 days per week for 12 weeks) and an incidental ingestion rate of 480 mg/day. <i>This higher frequency of exposure (60 days per year), and perhaps the higher incidental ingestion rate, seem justified based on some of the potential activities identified in Section 6.1.1.1 which suggest longer, more intense exposure (e.g., pipeline or bridge installation). Thus, TCEQ's evaluation of a construction worker would likely be much more conservative and may lead to different conclusions that those ultimately contained in the BHHRA.</i> Additionally, using these TCEQ construction worker rates would result in construction worker sediment screening levels similar to TCEQ recreational receptor PCLs (i.e., would indirectly protect potential recreational receptor exposure to sediment).	<ol style="list-style-type: none"> <li>1. The JDG agrees to use a 60 day/year exposure frequency in the selection of COPC (e.g., to calculate screening levels in Appendix A) for the construction worker scenario.</li> <li>2. The JDG believes that 100 mg/day incidental sediment ingestion rate is appropriate, as any activities conducted at the site will be performed under a health and safety plan that will minimize any exposure to sediment contaminants through the use of engineering controls and personal protective equipment.</li> </ol>	
9	Sections 5.2.1, 5.3.4 and Table 5-7	<b>TCEQ/</b> Section 5.2.1 appears to indicate that sediment COPCs with maximum detections or detection limits less than their screening levels at an HQ of 1 were eliminated from the BHHRA. <i>This screening procedure has the potential to eliminate COPCs which could have contributed significantly to the HI</i> Just two eliminated COPCs at 60% of their screening levels would correspond to a HI (1.2) which exceeds USEPA's target HI of 1. <i>Additionally, no consideration is given in this screening process to the potential uptake of these copes from sediment into fish/shellfish tissue.</i> Sediment screening levels based on uptake into edible tissue would be useful for this purpose. The methodology TCEQ uses may be found in TRRP-24 at <a href="http://www.tceq.texas.gov/publications/rg/rg-366_trrp_24.html/at_download/file">http://www.tceq.texas.gov/publications/rg/rg-366_trrp_24.html/at_download/file</a> . Lastly, all 12 detected COPCs listed in this section as without USEPA screening levels (to be evaluated only in the uncertainty section of the BHHRA) would have TRRP PCLs. However, based on review of maximum detections in Table 5-4, it does not appear that these 12 COPCs would contribute significantly to estimated risk/hazard for exposure to sediment. <i>Also in regard to sediment COPC screening, Section 5.3.4 refers to a relative risk screening procedure that has the potential to eliminate copes with concentrations sufficiently high that they may need to be specifically addressed.</i> COPCs were eliminated if their screening HQ contributed less than 5% to the screening HI. If the screening HI is significantly elevated due to a few chemicals having very high screening HQs, the likelihood of eliminating a COPC with a lesser but still significant HQ in the context of a BHHRA is increased. <i>For example, dieldrin and hexachlorobutadiene were eliminated, although per Table 5-7 their screening HQs exceed 1.</i> For a BHHRA using appropriate EPCs being evaluated by TCEQ, an HQ of 1 for a chemical would be unacceptable and require some type of remediation action.	<ol style="list-style-type: none"> <li>1. The language in this section will be revised to reflect that a HQ approach was not used in the selection of COPC. Rather, maximum detects were compared to a screening level based on a carcinogenic or non-carcinogenic scenario (whichever is more conservative for an individual chemical). Carcinogenic screening levels were calculated based on a target cancer risk of <math>1 \times 10^{-6}</math> and non-carcinogenic hazards based on a target hazard quotient of 1.0. These target risk and hazard quotients are based on those presented in the USEPA Mid-Atlantic Regional Screening Level tables and are consistent with those found in USEPA's RAGS Volume 1, Part B (USEPA 1991) for identifying contaminants of concern (COC). Chemicals that did not exceed their respective screening level were dropped from further consideration as COPC.</li> <li>2. The JDG does not support the use of sediment data and generic BSAFs to estimate fish tissue residues in the BHHRA given the great degree of uncertainty in the generic BSAF approach for the target fish and shellfish species [see response to TCEQ comment #1]. Rather, this pathway will be addressed using tissue residue data from fish and shellfish.</li> <li>3. RAGS Volume 1, Part A (USEPA 1989) recommends using a concentration toxicity screening approach to identify chemicals that may contribute most significantly to risk and to focus the risk assessment on these chemicals; the analysis in Section 5 is consistent with this guidance.</li> </ol>	
10	Section 8.1.1.3	<b>TCEQ/Section 8.1.1.3</b> This section indicates that remedial action is generally not warranted where RME excess cancer risk does not exceed the upper end of the USEPA acceptable risk range ( $1 \times 10^{-4}$ ). <i>Please note that the individual-chemical target risk level not to be exceeded under §350.72 of TRRP is <math>1 \times 10^{-5}</math>.</i> Additionally, there is a multiple-chemical cumulative risk check of no more than $1 \times 10^{-4}$ . Under TRRP, the exceedance of <i>either</i> of these target risk levels requires some type of action (e.g., removal, controls).	Section 8.1.1.3 indicates that any <i>individual</i> COPC with an excess lifetime cancer risk (ELCR) of $1 \times 10^{-6}$ will be identified as chemical of concern (COC) in the risk characterization.	

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11	Table 6-2	<b>TCEQ/Table 6-2</b> This table indicates that the dermal absorption fraction for PCB congeners is 0.14, but that the dermal absorption fraction for dioxins/furans (0.03) will be used when evaluating the dioxin-like PCB contribution to the toxicity equivalency quotient (TEQ). <i>TD believes the dermal absorption fraction for PCB congeners should be the same (0.14) regardless of the evaluation (as PCBs versus contribution to the TEQ).</i>	According to USEPA guidance, the dermal absorption factor PCB congeners is 0.14 (USEPA 2004). According to the same USEPA guidance the dermal uptake for dioxins/furans is 0.03. Based on this guidance, we do not think there is a need to change the dermal absorption factor for PCB congeners to be the same as that for dioxins/furans.  USEPA, 2004. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Final. Office of Emergency and Remedial Response. USEPA/540/R/99/005. July 2004.	
12	Tables 7-1 and 7-2	<b>TCEQ/Tables 7-1 and 7-2</b> USEPA should determine if 156,000 per mg/kg-day is the proper oral slope factor (Sfo) for dioxin given the draft Sfo (1,000,000 per mg/kg-day) and status of the draft dioxin reassessment. The same comment applies to the MRL/RfD to be used in the BHHRA.	We will use 156,000 per mg/kg-day as the oral slope factor (Sfo) for dioxins.	
1	p 10, ¶ 1	<b>USEPA</b> Please further explain. “will always be estimated”. Please provide some explanation for how estimations may be conducted.	The contribution of COPCs from Patrick Bayou for recreational-sized fish and blue crab caught at San Jacinto Monument Park will always be estimated, as there is no mechanism to directly measure that contribution. For example, the proportional contribution of PCBs that may have originated from Patrick Bayou to total PCB risks to consumers at the POE will be evaluated. This analysis will provide the quantitative linkage needed to assess the potential benefits of remediation within Patrick Bayou to off-site risks.	
2	p 10, § 3.2.1, ¶ 1	<b>USEPA</b> It is fine to suggest a pathway is insignificant, however this is not the same as incomplete. Insignificant pathways should be addressed in the risk assessment even if only briefly and qualitatively. Incomplete pathways are shown to not exist currently or likely not in the future and may not be addressed quantitatively or qualitatively. However unlikely, this pathway is possible and should be addressed.	Agreed. Incidental ingestion and dermal contact to surface water for a future construction worker and on-site maintenance worker (see response to TCEQ comment #1) will be identified as complete but minor and evaluated in the uncertainty analysis. We also agree that incomplete pathways are those that will not be evaluated quantitatively or qualitatively in the BHHRA.	
3	§ 5.1	<b>USEPA</b> This document cites that Regional Screening Levels were accessed in early 2010. These values are updated twice a year, therefore it is recommended that the most current version be used.	We will check as recommended.	
4	p 18, § 5.1, ¶ 2	<b>USEPA</b> It is stated that a construction worker spends 20 days at the site. Is this an average, or an expected maximum. It seems that 20 days is quite short for some possible scenarios. Recommend calculating risk for more several possibilities of days a construction worker may be on site (e.g., 20, 40, 60, 120 days).	For the construction worker scenario, the exposure frequency will be increased from 20 days/year to 60 days/year in the screening level calculation scenarios (see Appendix A). These revised screening levels will be used to ‘re-screen’ sediment data to identify COPC for this receptor.	
5	p 24, § 5.4, ¶ 1	<b>USEPA</b> A decreasing trend in tissue concentration might be expected if Patrick Bayou served as a source, however it should be noted that this thought process could be clouded by the possibility of other sources. Concentrations trends could in fact remain stable <i>with</i> Patrick	Agreed. A primary purpose of collecting tissue data from the site is to: 1) evaluate if the site is a significant source of contaminants in fish and shellfish in the HSC with regards to PCBs and dioxin/furans, and 2) evaluate the potential incremental risk to	

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		Bayou <i>also</i> being a source. Tissue concentrations could also remain stable due to the nature of the COPCs hydrophobicity <i>regardless</i> of source.	offsite receptors (i.e., fisherman) from tissue residues in fish and shellfish linked to the site (i.e., how much of the total risk associated with fish and shellfish caught and consumed from the HSC is related to contaminants that originated from Site media?). It is important to address the question of incremental risk due to the other multiple potential sources within the HSC (and beyond), as was noted by the reviewer. If subsequent risk-based preliminary remediation goals (PRGs) are developed based on the assumption that tissue body burdens of fish and shellfish in the HSC (or site itself) are solely due to contaminants in Site media (e.g., sediments), site remediation would be disproportionate to actual risk associated with this pathway.	